AMENDED CLAIM SET:

1. (previously presented) A method for estimating a NOx occlusion amount **x** of a NOx occlusion catalyst interposed in an exhaust passage in an engine, comprising first obtaining means for obtaining an actual NOx concentration at an inlet of said NOx occlusion catalyst, second obtaining means for obtaining an actual NOx concentration at an outlet of said NOx occlusion catalyst, and actual NOx purification rate calculating means for calculating an actual purification rate of said NOx catalyst sequentially based on a ratio of the actual NOx concentration at said inlet to the actual NOx concentration at said outlet, said method characterized in comprising the steps of:

calculating a NOx discharging amount in said NOx occlusion catalyst according to the following equation:

NOx discharging amount = $\int$ (reducing agent concentration at catalyst inlet $\times$ reducing agent utilization rate $-$ 0.5 $\times$ oxygen concentration in catalyst inlet) $\times$ exhaust gas flow rate,

wherein said reducing agent utilization rate is set on the basis of exhaust gas temperature **y** and exhaust gas flow velocity **z**, and at the same time the characteristics of the reducing agent utilization rate are stored in a reducing agent utilization rate setting map,

estimating said NOx occlusion amount **x** using a polynomial reflected with NOx occlusion characteristics which include an estimated NOx purification rate **r** of said NOx occlusion catalyst, [[an]] the exhaust gas temperature **y**, and [[an]] the exhaust gas flow velocity **z**, wherein said polynomial is a polynomial obtained by multiplying said exhaust gas temperature **y** and said exhaust gas flow velocity **z** by respective coefficients,

correcting each coefficient of said polynomial sequentially to become said estimated NOx purification rate calculated by said polynomial equal to the latest actual NOx purification rate calculated by said actual NOx purification rate calculating means, and

judging that said catalyst is abnormal when an average value of each said coefficient in a predetermined period is deviated from a predetermined range.

2. (cancelled).

3. (prcviously presented) A method for estimating a NOx occlusion amount according to claim 1, characterized in that said polynomial is expressed by the following equation:

$$x = [r - (k_0 + k_2y + k_3z \ldots)] / (k_1 + k_4y + \ldots)$$

here, ki (i = 1, 2, ...) are coefficients.

4. (previously presented) A method for estimating a NOx occlusion amount according to claim 1, characterized in that said correcting step comprises, in an occasion of correcting said coefficient sequentially:

estimating the (N+1)-th NOx purification rate r on the basis of the N-th (N is a natural number) NOx occlusion amount x obtained from said polynomial, and

correcting each coefficient such that said estimated (N + 1)-th NOx purification rate r becomes the NOx purification rate r actually measured.

5. (original) A method for estimating a NOx occlusion amount according to claim 4, characterized in that the coefficient is corrected by using the method of least square.

6. (cancelled).

7. (cancelled).

8. (currently amended) A method for estimating a NOx occlusion amount according to claim 1 [[6]], characterized in that:

said reducing agent utilization rate is estimated using a polynomial which is reflected with a NOx discharging characteristics of the NOx occlusion catalyst, and

the coefficients of said polynomial are sequentially corrected on the basis of the concentration of reducing agent.

9. (original) A method for estimating a NOx occlusion amount according to claim 8, characterized in that:

the polynomial for obtaining the reducing agent utilization rate r' includes a catalyst inlet reducing agent concentration x', an exhaust gas temperature y and an exhaust gas flow velocity z, and

said polynomial is a polynomial obtained by multiplying said catalyst inlet reducing agent concentration x', said exhaust gas temperature y and said exhaust gas flow velocity z by respective coefficients.

10. (previously presented) A method for estimating a NOx occlusion amount according to claim 9, characterized in that the polynomial for obtaining the reducing agent utilization rate r' is expressed by the following equation:

$$r' = f(x', y, z)$$
$$= m_0 + m_1 x' + m_2 y + m_3 z + m_4 x' y + m_5 yz + m_6 zx' + m_7 x'^2 y + m_8 x' y^2 + \ldots\ldots\ldots$$

here, m_i ($i = 1, 2, \ldots$) are coefficients.

11. (original) A method for estimating a NOx occlusion amount according to claim 1, is characterized in that:

said engine is constituted such that switching can be performed between a lean operation where an exhaust gas air-fuel ratio is lean and a rich operation where said exhaust gas air-fuel ratio is rich, and

said coefficients of the polynomial are held during said rich operation, and when a difference between the NOx purification rate obtained by using said held coefficients at a starting time of the lean operation and said NOx purification rate actually measured is equal to or more than a threshold value, said NOx occlusion amount is corrected.

12. (original) A method for estimating a NOx occlusion amount according to claim 11, characterized in that the NOx occlusion amount is corrected, when a difference between an actually measured value of the NOx purification rate r at the starting time of the lean

operation of said engine and an estimated value thereof is equal to or more than a threshold value.

13. (original) A method for estimating a NOx occlusion amount according to claim 12, characterized in that said NOx occlusion amount is corrected based upon a judgment that a NOx occlusion amount calculated at the starting time of the lean operation is incorrect, when a difference between said NOx purification rate estimated by the polynomial and the NOx purification rate obtained by actual measurement immediately after switching is performed from the rich operation of said engine to the lean operation thereof is equal to or more than a predetermined value.

14. (cancelled).